Super Science High School (SSH)

Osaka Prefectural Otemae High School

International High School Science Conference Report

"On World Environmental and Energy Problems"

Mar, 26th , 2019 @ EL Theater Hall at EL Osaka

Participating Schools

Beijing 101 Middle School (People's Republic of China) 北京 101 中学（中華人民共和国）

Shanghai Foreign Language School Affiliated to SISU (People's Republic of China) 上海外国語大学附属外国語学校（中華人民共和国）

Hansung Science High School (Republic of Korea) 漢城科学高校（大韓民国）

Chulalongkorn University Demonstration Secondary School (The Kingdom of Thailand) チュラロンコン大学附属高校（タイ王国）

Balcombe Grammar School(Commonwealth of Australia) バルコムグラマースクール（オーストラリア連邦）

Osaka Prefectural Otemae High School (Japan) 大阪府立大手前高等学校（日本）

Preface

Today, I am most grateful to all of you for participating in the 4th International High School Science Conference. I am honored to welcome students and teachers from the People's Republic of China, the Kingdom of Thailand, the Commonwealth of Australia, and a guest teacher from the Republic of Korea.

We had a series of natural disasters last year: the earthquake in Osaka, extreme heat in summer because of global warming, and huge typhoons in September which caused bad damage across Osaka. Today, under such circumstances, we are going to exchange research on "Environment and Energy." This is one of the biggest global challenges, and we have to tackle it with wisdom from around the world.

It is so meaningful that young high school students full of promise give presentations and exchange opinions on this issue. I strongly believe that it will be a great help for realizing our sustainable society, that you will learn and experience a lot through this conference, and that you will continue working on it in the future. Although we only have a short time, I hope that this conference will be a great opportunity for all of us and that we will have a meaningful time together.

Finally, I would like to express my heartfelt gratitude to our alumni association, Kinrankai, Osaka Prefectural Board of Education, and Japan Science and Technology Agency for your great support to hold this conference.

Principal of Otemae High School
Matsuda Masaya

Program

International High School Science Conference

1 Opening Ceremony *12:50～*

2 Research Presentation *13:13～*

3 Closing Ceremony *15:55～*

1. About Participating Schools

Chulalongkorn University Demonstration Secondary School

Chulalongkorn University Demonstration Secondary School <CUD> or Satit Chula for short, was founded on June 20th,1958 by Professor Thanpuying Poonsapaya Navawongs na Ayudhya,the first Dean of the Faculty of Education,Chulalongkorn University. In 1969 the school was divided into a primary school which takes charge of pre-elementary and grades 1 to 6, and a secondary school which is responsible for grades 7 to 12.

Vision

We aim to be the hub for high-school educational management and the professional training center of excellence.

Mission

CUD has five missions;

1. To serve as the teaching and research laboratory of the Faculty of Education.
2. To educate and develop the students morally, spiritually, physically, and socially.
3. To improve teachers'teaching techniques.
4. To develop educational innovations.
5. To maintain and promote Thai arts and cultures.

Emblem

Prakiew, the royal emblem of King Chulalongkorn, the founder of the university.

School Colour

Pink-Pink signifies Tuesday, the birthday of King Chulalongkorn.

Education Management

CUD, as the laboratory for the Faculty of Education, has two major roles as follows:

1. The school provides basic education for grades 7th to 12th students, according to the National Curriculum 2001, and encourages teachers to do classroom researches along with teaching on the basis of the student-centered approach to enhance effective learning outcome. Our curriculum aims to provide students with:
   - 1.1. Free elective courses relating to students'interests and skills.
   - 1.2. Specially designed programs to serve the needs of the students:
     - 1.2.1. CU-AP Program for the advanced learners to fulfill and develop their capabilities to the fullest.
     - 1.2.2. Ability grouping to facilitate students'learning paste and style.
     - 1.2.3. Preparation courses for students who join international academic competitions.
     - 1.2.4. Extra courses for fast and slow learners.
   - 1.3. Extra curricular activities such as homeroom, guidance, social service, scout activities, and clubs.
2. The school also provides university level education. Student teachers who come to intern at CUD will have a chance to practice and prepare themselves to become successful teachers in the future.

Beijing No.101 Middle School

Location
Located in the old summer palace, the school's main campus has a unique and natural environment, with 5 artificial lakes inside. It is also in the heart of Zhongguancun science park, where Tshinghua University and Peking University are across the street.

History
Founded in 1946, Beijing No.101 Middle School is the only middle school which was established in revolutionary base area and then relocated to Beijing. In 1955 the school was renamed according to the suggestion of Guo Moruo, its new name, 101, would symbolize to be better than perfect. Beijing No.101 Middle school is a key and model school of Beijing. Through seven decades, Premier Zhou Enlai and Premier Wen Jiabao visited the school, and general Secretary Jiang Zemin and Chairman Li Peng wrote inscriptions for the school.

Academic Achievements
- 8 campuses, with a total of 8000 students.
- 30,000 and more alumnus, including national leaders, scholars and experts with high reputation, and role models
- 100% Graduates Matriculated to First-Tier Universities in China
- 5 graduates achieved highest Gaokao scores
- Students have received many awards in National and International competitions.

Faculty
Beijing No.101 Middle School is proud to have highly ethical, professional and innovative teaching faculty.
- 7 Teachers recognized as National Model in Education andNational Outstanding Teacher
- 11 Distinguished Senior Teachers
- 98 Key Teachers recognized by city of Beijing

Facilities
Facilities on campus are highly modernized. Multimedia teaching equipment are used in classrooms. The school contains e-reading rooms, the library, the digital teletorium, Virtual Studios, scientific experiment grounds, the astronomic observatory, the music rehearsal hall, the volleyball court, the gymnastics gym, the table-tennis gym and the soccer field of natural meadow etc.

International Outreach
With advanced education scope, school continues to strengthen international exchange and cooperation. It has established cooperation with schools from the United States, UK, Germany, France, Japan, Switzerland and Sweden. To cultivate talents with international vision and global competence, the school has introduced many international courses. Through the integration of traditional Chinese education and International curriculum, the school has developed an internationalized education approach suited to Chinese students. More than 100 graduates matriculated into top Universities in the world including University of Oxford, Harvard University, Yale University, Columbia University, University of Pennsylvania, etc.

BALCOMBE
GRAMMAR SCHOOL

Balcombe Grammar School is on the Mornington Peninsula, Victoria, Australia. The school was founded in 2007 having been brought into existence through the efforts of a dedicated group of people who had the vision to provide an affordable Christian school striving for excellence in education. Balcombe Grammar School is a co-educational school with classes ranging from Foundation to Year 12; from 5 years old to 18 years old.

The school is located close to the beautiful Port Phillip Bay, surrounded by beautiful beaches, amazing wildlife and a lot of rich heritage. This privileged location means that our school community is constantly reminded of the importance of nature, and we strive to be environmentally conscious, with a range of student led sustainability programs.

The school has a reputation for innovation and has developed a range of programs that encourage the students to take their learning beyond the classroom and to be curious about the world. With exceptional facilities and teaching staff, students have been supported in their endeavours to participate in National Youth Science Forums, the University of Melbourne STEM Program, and various National Science and Mathematics Competitions.

Balcombe takes a holistic approach to learning and celebrates achievement in a range of disciplines, including Visual and Performing Arts, Sports and Academics. In addition, it fosters positive relationships through Community based activities and Wellbeing focussed programs. These aim to raise awareness of social issues and teaches students key leadership and interpersonal skills such as confidence, understanding, empathy, resilience and responsibility.

MISSION STATEMENT

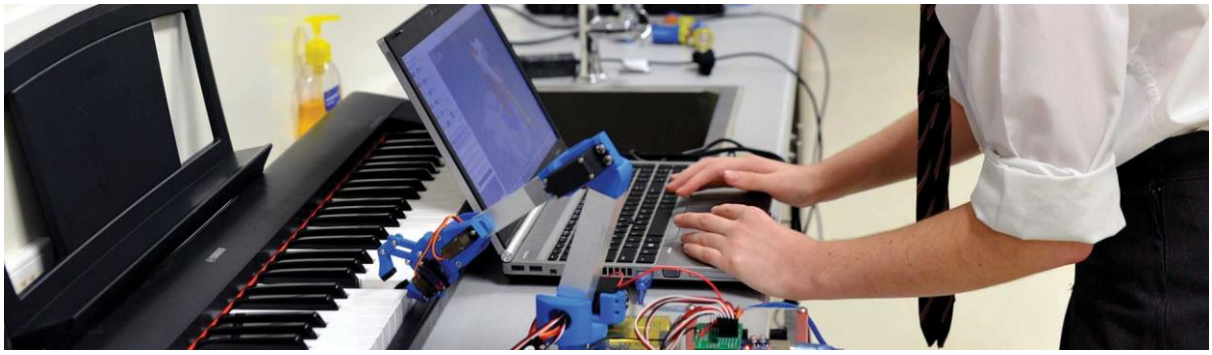
To provide a dynamic learning community, based on Christian values, committed to the realisation of each student's unique potential.

VISION STATEMENT

- To provide a sustainable, inclusive environment that creates personalised opportunities for challenge and success.
- To set high standards for continual learning.
- To prepare students to become enterprising and active global citizens.

VALUES

- Compassion
- Confidence
- Inclusion
- Curiosity
- Optimism



A Brief Introduction to Shanghai Foreign Language School (SFLS)

Founded in 1963 under the command of China State Council, Shanghai Foreign Language School Affiliated to SISU is one of the first 13 foreign language schools in China that comes directly under the Ministry of Education. Our school sticks to the principle of "striving for the development of our nation as well as all human beings".

With the motto "self-improvement, utmost sincerity, highest aspirations", SFLS has always been dedicated to cultivating global elites in the past 55 years. Every year, SFLS enjoys a steadily large flow of students going to the prestigious universities home and abroad, including but not limited to Harvard University, Yale University, University of Toronto, University of Tokyo, Waseda University, Tsinghua University. Our alumni are all around the world and have made success in walks of life, proactively making contribution to the world in one way or another. Yang Jiechi (State Councilor, former Minister of Foreign Affairs), Cui Tiankai (Vice Minister of Foreign Affairs, Chinese Ambassador to the US) and Wang Guangya (Former Chinese representative at the UN) are all outstanding alumni of SFLS.

The school curriculum features its multilingual courses. Courses on 11 foreign languages are provided in the curriculum, including English, Japanese, German, French, Russian, Spanish, Arabic, Persian, Hindi, Hebrew, and Italian.

Every student from 6th grade to 12th grade is required to learn at least one foreign language other than English, and is encouraged to learn 3 or even more at the same time. For numerous times have our students have won the championship of speech contests and debate competitions in English, Japanese and German, and many of them have already won certificates in interpretation.

But life in SFLS is much more than learning foreign languages. The annual Chinese Culture Festival and International Culture Festival highlight the various activities on campus. Also, there are 45 student-led clubs in total, which provide students with a wide range of choice as extracurricular activities. Through participation in club activities, students develop their interests and leadership skills, and learn how to cooperate with others in different situations.

Ever since the founding of SFLS, we have put great emphasis on maintaining close ties with schools and institutions throughout the world. By the end of 2017, our school had established 31 sister school partnerships in America, Europe, Oceania, and many other countries and regions, and more than 60 exchange programs have been regularized. From 2013 to 2017, 1691 students and 245 teachers participated in 134 exchange programs in 20 countries, and meanwhile, 1025 students and 492 teachers hosted 135 exchange groups coming from 10 countries.

Hansung Science High School

279-79, Tongil-ro, Seodaemun-gu, Seoul, Republic of Korea

Hansung Science High School was founded in 1992 to nurture the development of gifted students in mathematics and science. Our school selects academically-talented students and help them realize their academic potential with the most professional teachers in Korea, numerous math and science learning programs, and well-equipped facilities. Since 1992, over ~~2000~~ students have benefited from our education and our school has become a model for the education of students in Korea.

School Motto of HSHS is "Creativity." We know that imagination is more important than knowledge. Our goal is not to simply provide math and science information, but to inspire them to enhance their creativity, and integrate learned knowledge to solve the real-world problems.

Hansung Science High School encourages students not only to achieve advanced intellectual and academic skills but also to develop their characters as responsible citizens and leaders. HSHS strives to fulfil the following aims as our mission:

To help students grow to be leading scientists in Korea and beyond:

- Students increase their motivation for learning math and science.
- Students promote their creativity and develop advanced research skills.
- Students learn more advanced math and science including university level classes - Advanced placement(AP).
- Students increase their integrated thinking ability to have an engineering approach towards problems while building on math and science base.

To help student build their characters:

- Students have opportunities to develop their social skills and interests.
- Students contribute to the community by participating in volunteer works.
- Students understand the value of respect and responsibility and develop their ethical and moral awareness.

Hansung Science High School has been designated as a special research school by the Seoul Metropolitan Office of Education and the Ministry of Education, Science and Technology Department. Up-to-date laboratories – such as observatory are free to use for students, so they can plan and carry out their own research. Numerous research and experiment programs help students not only learn research skills but also open their eyes to the future research.

Various student-run clubs are one of the features of our school. From the chemistry experiment club to the magic performance club, a lot of clubs are being run by students covering a wide field. If satisfactory club doesn't exist, it is also possible to make a new club. It makes students have multifarious experiences and close connection with others.

The dormitory can accommodate all of the students, so anyone who want can use the dorm. It makes students attend school conveniently, and comfortably. The dormitory also has advantages for making intimate relation of friends.

Our graduation program allows the students who completed all requirements and finished the evaluation procedure to leave high school and begin university a year ahead of other students. Permission for early graduation is granted by early graduation board and approved by the school principal.

Osaka Prefectural Otemae High School

History

In 1886 Otemae high school was established as "Osaka Prefectural Girls' School." Since then, it has produced countless graduates who have taken leadership roles in many fields, and have been widely renowned for it. With our motto, "Strong Belief and High Ideals", we aim to educate and support our students so that they can grow sound in mind and body, realize their dreams, and contribute not only to Japanese society but also to the international community.

School Life

Otemae High School changed into a coeducational school after World War II, as many public schools did at that time. Our school has two courses; full-time and part-time (night-time). Currently more than 1,000 students study here. Here, we will give a broad outline of the full-time course.

School begins at 8:30 a.m. and ends at 3:20 p.m. Each lesson lasts 65 minutes, and there are five lessons a day. On Saturdays, there are no lessons, but study rooms are open. In our school many kinds of events take place, including the cultural festival, the sports competition and school excursions. Especially as the spring chorus competition comes near, students come to the school early in the morning and practice singing eagerly before school.

Like many Japanese schools, our school also has a variety of club activities. For example, baseball, soccer, judo, kendo (Japanese fencing), tennis, swimming, track and field, rugby, symphonic band, tea ceremony and so on. About 90 % of the whole students club activities.

We are proud that a lot of students are interested in mathematics or science. Some of them are engaged in the studies with the advice of national university professors, others have won competitions in math or computer programing. Various science study programs are held through the academic year.

International Education

We know that International Education is essential to students in today's world, we give students a lot of opportunities to take part in international programs. Every year more than 170 students take part in study program in the USA, Australia, or Singapore. We are in partnership with Penglais High School in Britain and Balcombe School in Australia, and carry out exchange programs every year.

2. About Research

Potential use of agricultural waste biochar for canteen wastewater treatment

Norakamon Ariyakanon[1], Chalisa Vikrompanitkul[1], Sujika Jaturonpongsa[1], Naiyanan Ariyakanon[2]

[1] Chulalongkorn Demonstration Secondary School, Chulalongkorn University

[2] Department of Environmental Science, Faculty of Science, Chulalongkorn University

Abstract:

The efficiency of biochar derived from local agricultural waste for wastewater remediation was investigated. Biochars were prepared from rice straw, bagasse or coir, produced low temperature pyrolysis at 300 $\pm$ 10^{O}C for 1 h. Physiochemical characteristic of biochar such as grain size distribution, pH and electric conductivity (EC) were determined. Characterization of biochar was achieved by scanning electron microscopy (SEM). The physical and chemical parameters of wastewater were analyzed before and after treatment with the three different types of biochar. Measured parameters included, pH, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), oil and grease, total phosphorus (TP) and total nitrogen (TKN). The results showed that three biochars were most effective at the removal of oil and grease (97-98%), TSS (92-95%) and COD (75-91%). This study suggested that biochar made from rice straw, bagasse and coir had a potential to be used as low-cost adsorbents for wastewater treatment.

Key words: biochar, agricultural waste, canteen wastewater

Application of Hybrid TiO_2 Photocatalytic Reaction in Waste water Treatment

Bingrui He, Beijing 101 Middle School, China

Hello everyone, I'm Bingrui He, from Beijing 101 Middle School in People's republic of China and the topic of my project is the Application of the Hybrid TiO_2 Photocatalytic Reaction in Waste water Treatment. And I'm going to introduce my project through the following four parts.

The problems of waste water treatment is known as one of the major topic of discussion nowadays while TiO_2 nanoparticles are widely used in these areas and deemed as the most ideal semiconductor photocatalyst due to their great advantages. However, as a semiconductor compound with large energy gap, TiO_2 can only absorb ultraviolet light with a wavelength less than 387 nanometres, while ultraviolet light accounts for only 3 percent of the solar energy irradiated on the ground, which makes it difficult for industrial utilization. Polyvinyl alcohol which is PVA for short is a water-soluble polymer material containing a large amount of hydroxyls which will be degraded when heated during range from 180° C to 280° C. The dehydration and condensation reaction of hydroxyls within and between the molecular chains of PVA results in the formation of carbon to carbon conjugated structures, thus extending the light response of TiO_2 to the visible region.

The purpose of my project is to search a new route for preparing PVA_D-g-TiO_2 nano hybrid photocatalyst with visible light photocatalytic activity, which is also simple, cheap and have industrial application prospect. And furthermore, discuss the problems of the sample's chemical structure, interface electron transport, preparation conditions-photocatalytic-structure relations and explore effects of the mass ratio of TiO_2 and PVA and degradation temperature on sample's visible-light photocatalytic property.

To prepare the sample, first add water, TiO_2 nano, Polyethylene glycol, PVA and methanol into the same beaker and stir the intermixture mechanically at the same time. Name the presoma product prepared by Coagulation Method as TiO_2@PVA with different mass percentage of TiO_2 and PVA. Then filter, grind and collect it. Last, weigh the above-mentioned presoma powders, place them in crucible and collect them after burning them for certain times in muffle furnace with certain temperature. Name the nanoparticles prepared by Controllable Degradation as PVA_D-g-TiO_2.

Here I give a possible conjecture diagram of the mechanisation of the sample preparation route. The process is divided into two periods: First, PVA coated on the surface of TiO_2 reacts with TiO_2 to form PVA-g-TiO_2 in heating-up process, and graft PVA chemically on TiO_2 surface; Secondly, when the temperature is raised to a certain level and kept constant, PVA grafted on the surface of TiO_2 will degrade and eventually produce PVA_D-g-TiO_2. There are a lot of conjugated structures in the PVA_D produced by the degradation of PVA which can help TiO_2 to absorb solar spectrum effectively.

In order to obtain more detailed structural characteristics, the samples were characterized by reflection infrared which is ATR/FTIR for short. We can observe from the figure that compared with pure TiO_2 nanoparticles, two new characteristic peaks appeared at 1715 and 1602 for PVA_D-g-TiO_2 nano hybrid. They are the stretching

vibration peaks of -C=O- and -C=C- respectively formed after heat-degradation and dehydration of PVA. Also, another new characteristic peak appeared at 1261. It's the stretching vibration peak of Ti-O-C formed after the dehydration and condensation reaction between PVA and TiO_2 nano particles. We can know well from the figure that PVA was chemically grafted onto the surface of TiO_2 nanoparticles, and at the same time degraded to form -C=C- functional group. Now we come to know that abundant -C=C- functional group was created after the degradation of PVA. In order to study whether these functional groups are single or linked to form conjugated structures, the samples were characterized by electron paramagnetic resonance which is EPR for short. It can be seen from the spectrogram that pure TiO_2 nanoparticles have no EPR response, while PVA_D-g-TiO_2 nano hybrid has strong EPR response, that is to say, there are unpaired electrons in the sample, which indicates that the sample does contain the conjugated structure of the double bond of carbon to carbon. It can be seen from the ERP spectrogram of PVA_D which is produced by degradation of pure PVA has a strong EPR signal, which indicates that the sample contains a large number of conjugated structures. But there's only a small amount of PVA coated on the surface of PVA_D-g-TiO_2 nano hybrid, so the conjugated structure formed after degradation is relatively small and its EPR signal is relatively weak.

I also characterized the optical properties of the samples by ultraviolet-visible diffuse reflection spectrum. The results are shown in the figure that both pure TiO_2 nanoparticles and TiO_2@PVA presoma can only absorb ultraviolet light while PVA_D-g-TiO_2 nano hybrid particles not only absorb in the ultraviolet region, but also in the visible region above 400 nanometre, thanks to the π bond electron transport in the conjugated PVA_D layer grafted on the surface of TiO_2. Also, PVA_D has a wide range of absorption in the ultraviolet and visible light regions, which indicates again that conjugated structures of different lengths are formed after degradation of PVA and the absorbing capacity of the samples is improved.

When it finally comes to the photocatalytic experiment, I take methyl orange, phenol and formaldehyde as the target pollutants with the initial concentrations of 15, 10 and 5.8 milligram per litre respectively. The visible light photocatalysis experiment was carried out in a photochemical reactor with a 500watt iodine-tungsten lamp with an external optical filter to filter ultraviolet light below 450 nanometre to ensure the visible light source of above 450 nanometre. Sample powders containing 10 milligrams of TiO_2 nanoparticles were separately weighed and dispersed in the initial solution of 10 millilitre target pollutant before illumination. After illumination, the suspension was centrifuged at regular intervals, and the upper clarified solution was taken to measure its absorbance. Pure TiO_2 nanoparticles and physically mixed PVA_D and TiO_2 powders were experimented in parallel as contrast. The absorbance of methyl orange solution at 465 nanometre maximum absorption wavelength was measured to describe its concentration change. The average value was obtained by three repeated steps. And the degradation degree of methyl orange was described by the latest concentration divided by the initial concentration which indicates the latest absorbance divided by the initial absorbance, and draw the curve of the results of division varying with illumination time.

Here shows the results of the photocatalytic experiment I mentioned before. Compared with pure TiO_2 nanoparticles, PVA_D-g-TiO_2 hybrid photocatalyst has an

excellent visible-light photocatalytic activity. However, PVA_D itself has no photocatalytic activity, which indicates that the visible light photocatalytic reaction can only be carried out when PVA_D is combined with TiO_2. Under visible light, PVA_D-g-TiO_2 nano hybrid photocatalyst can not only degrade model pollutant methyl orange effectively, but also degrade refractory phenol and formaldehyde as target pollutants effectively. After 6 hours of visible light, the degradation rate of phenol is almost 100%. The photocatalytic rate of formaldehyde is slower for it's more difficult to be degraded.

In order to obtain highly effective and controllable PVA_D-g-TiO_2 nano hybrid photocatalyst, I've further studied the effects of mass ratio of TiO_2 and PVA on the sample's photocatalytic properties. This figure shows the BET specific surface area of samples with different mass ratios of TiO_2 and PVA, and the variation trend of which is consistent with the same photocatalytic results this figure shows. When the ratio of TiO_2 and PVA decreases from 200to1 to 20to1, the coated amount of PVA increases and the corresponding content of conjugated structure increases, so the photocatalytic efficiency increases with the increase of the amount of PVA added. When the ratio of TiO_2 and PVA is 20to1, the specific surface area of the sample is the largest and the reactive sites are the largest, so the photocatalytic efficiency of the sample is the best. When the ratio of TiO_2 and PVA continues to decrease from 20to1 to 1to1, the BET specific surface area of the sample decreases rapidly and the photocatalytic efficiency decreases thereupon. You see here are photos of the samples with different mass ratios of TiO_2 and PVA shot by electron microscope which can also prove my conclusion that when the ratio is 20to1, the TiO_2 particles have the best dispersal to react.

Another factor affects rate constant is controllable degradation temperature. This figure shows the photocatalytic rate of the samples first increased with the increase of the controllable degradation temperature until it rose to 220°C when the photocatalytic rate reached its maximum. Then the photocatalytic rate decreased continuously. I further characterized the content of conjugated structure in samples by EPR to study the effect of temperature on the formation of conjugated structure in samples. This figure shows that the content of conjugated structure increases first and then decreases with increasing temperature, which is consistent with the variation trend in the former figure. The EPR response of the samples is the strongest when the temperature is 220°C, indicating that the conjugated structure formed by PVA degradation is the most at this temperature, so the photocatalytic efficiency is the highest.

I guess the reason why PVA_D-g-TiO_2 has excellent visible photocatalytic activity is not only that the conjugated PVA_D layer on the surface can effectively absorb visible lights, but also that Ti-O-C between PVA_D and TiO_2 acts as an electron transport channel, which can effectively transfer excited electrons from PVA_D to TiO_2. Fast electron transport can effectively promote charge separation and reduce charge recombination, thus improving photocatalytic activity. The role of Ti-O-C chemical bond in photocatalytic reaction was studied by comparing the photocatalytic properties of chemically grafted PVA_D with physically mixed TiO_2 and PVA_D. This figure shows the degradation results of phenol by PVA_D-g-TiO_2, TiO_2 with PVA_D and pure TiO_2 under visible light. It can be seen from the figure that the photocatalytic activity of chemically grafted PVA_D-g-TiO_2 is the highest, while that of physically mixed TiO_2 and PVA_D is very low, which is basically the same as that of pure TiO_2. The huge difference between the photocatalytic activity of PVA_D-g-TiO_2 and TiO_2 with PVA_D indicates that Ti-O-C in

chemically grafted PVA_D-g-TiO_2 effectively improve the photocatalytic activity of the samples by electron transportation. In order to verify the above conclusions, electron transport in the sample was further characterized by electrochemical impedance spectroscopy which is EIS for short. The semicircle in this spectrum represents the confined process of electron transfer. The diameter of the semicircle is electron transfer impedance named R_{et}. The smaller the diameter, the smaller the impedance, that is, the better the conductivity. We can know that the semi-circle of chemical grafted PVA_D-g-TiO_2 is the smallest, indicating that its interface resistance and R_{et} are the smallest which beneficially indicates my conclusions right.

Based on the above discussions, I put forward a possible mechanism of PVA_D-g-TiO_2 nano hybrid visible-light photocatalytic shown in this figure. When it's irradiated by visible light, the conjugated PVA_D layer on the surface of hybrid photocatalyst effectively absorbs visible light, and the delocalized π electrons in the conjugated system are stimulated to transit and corresponding positive holes are generated, forming electron-hole pairs. Excited electrons are rapidly transferred to the conduction band of TiO_2 through Ti-O-C between PVA_D and TiO_2, which promotes the separation of electrons and holes and converts PVA_D into cationic free radical. Then, the electrons transfer to the surface of the sample and react with oxygen and water adsorbed on the surface to form a series of active oxygen species, such as anion radical oxygen and perhydrol, which have strong redox ability and can effectively degrade organics.

In conclusion, my project prepared a new PVA_D-g-TiO_2 nano hybrid photocatalyst with visible light photocatalytic activity by combining coagulation and controllable degradation. The results indicate that when mass ratio of TiO_2/PVA is 20:1 and is degraded at 220°C for 2 hours, it shows the best photocatalytic activity, which can not only degrade the model pollutant methyl orange, but also degrade the refractory organic pollutants such as phenol and formaldehyde effectively.

This method provides a new line of thinking for preparing PVA_D-g-TiO_2 nano hybrid photocatalyst with visible light photocatalytic activity, which is also simple and cheap. It will contribute to improving the utilization of sunlight and realizing the industrialization of photocatalytic technology.

Thanks for listening!

Comparison of Absorption Effect of Electrostatic Negative Ion Air Purifier on Pollution Particulate

Dong Hanchen, , Beijing 101 Middle School, China

I. INTRODUCTION

Students and Teachers ,good afternoon! My name is Dong Hanchen,I come from Beijing 101 Middle School.The name of my project is Comparison of Absorption Effect of Electrostatic and Negative Ion Air Purifiers on Polluted Particulate Matter.

Abstract

since 2013, the cold air activity affecting China's weather has been weaker than usual, with low and weak wind speed and stable atmosphere, resulting in frequent occurrence of haze.
Haze has seriously affected people's health, and many kinds of air purifiers are constantly appearing on the market. Therefore, I want to analyze the purifying effect of two kinds of purifiers with different technologies through research, so as to provide reference basis for people to choose air purifiers and reduce the harm of haze to human health.

Keywords：Haze; Air purifier; Negative ions; electrostatic

II. Experiment design

1.Experimental principle

This experiment mainly studies two kinds of air purifiers based on new technology, naming electrostaticair purifier and Negative Ion air purifier. The traditional filter adsorption air purifier is out of the scope of this study due to its high cost in the later stage.

The electrostatic air purifier uses the principle of anodic corona discharge to positively chargethe dust in the air. Then by virtue of coulomb force, charged particles are collected on the dust collecting device to achieve the purpose of dust removal and air purification. It is characterized by high dust collection efficiency, some purifiers dust collection efficiency as high as 80%, in addition to the capture of small particles (0.01 m ~ 0.10 m), and the pressure loss of dust collection device is less.

Negative Ion air purifier is a kind of environmental optimization appliance which uses the negative ions produced by itself to purify, dedust, deodorize and sterilize the air, and its difference with the traditional air purifier is to use negative ions as the action factor, actively strike to capture harmful substances in the air, without any noise, which can be used at night. Anion purification air purifier is characterized by fast inactivation speed, high inactivation rate, and have inactivated effect on microorganisms, bacteria and viruses on the surface of air and articles.

An important indicator of air purifier is the CADR value, which is the clean air output rate and an important index of air purifier's work efficiency. Another important indicator of air purifier is air volume, the effect of efficient purification comes from the strong circulating air volume.

The above two indicators are determined by different product categories.

This experiment mainly studies the purification effect of two air purifiers based on electrostatic type and negative ion type under the same air volume. In this experiment, two kinds of air purifiers were set at the same air volume, and their purification effects were compared in a relatively closed space

1. Experimental Props

- Air detector x3
- Warm shed x3(Basically can completely block the internal and external space air)
- Fragrance
- Negative Ion Converter Technology Air purifier x1
- Electrostatic technology Purifier x1
- Matches quantity

2. Experimental Methods

It is divided into three groups: A, B and C. A and B were the experimental group, and C was the control group.

Group A: air purifiers using electrostatic technology.
Group B: purifiers using negative anion converter technology.
Group C: no air purifier.

1) set up three tents respectivelyand close them around. Place an air detector (about 5cm off the ground) in the center of each tent and the purifier.

2) after that, ignite the three incense sticks, burning for 30 seconds (keep the sealed state), and then place it extinguished. Allow the smoke to diffuse for 3 minutes.

3) At 3 minutestimeslot, record the PM2.5 index measured by air detector for the 1st time, turn on the air purifier, and adjust the air purifier to the lowest level.

4) Thereafter, record the PM2.5 index measured by the air detector every minute until 15 minutes.

III. Experimental Results and Analysis

My experiment was carried out for three times, and three groups were recorded each time. Group A and B were the experimental group, and group C was the control group, and data of each group were recorded for 16 times.

（1）Experimental data for the first time(picture 1)

Three groupsPM2.5Indexcurve are shown in the figure:

（2）Experimental data 2nd time(picture2)

（3）Experimental data 3rd time

（4）Experimental Data Analysis

From the above analysis, the time for the dust concentration to decay from the initial value to half can be obtained:

The half-life of dust concentration is shown in the figure: (picture)

Dust concentration half-life time percentage is shown below:(picture)

The time when Dust concentration approaches zero:(picture)

The time for dust concentration closing to zero is shown in the figure: (picture)

Relative Percentage of time when Dust concentration approaching is shown in the following figure:(picture)

Through experiments, it was found that the dust concentration half-life of negative ion air purifiers was slower than that of electrostatic air purifiers, with an average delay of 59%. Without air purifiers, the dust concentration will not decrease.

In addition, the dust concentration in the air in the greenhouse where the anion air purifier is located is 66% longer than that in the greenhouse where the electrostatic air purifier is located, which is close to 0.

But eventually the PM2.5 index in the air in both greenhouses was close to 0. It shows that in a short period of time, the effect of electrostatic air purifier is better than that of anion type air purifier. However for a long time, both air purifiers keep the house in a relatively good environment. And without air purifier in the warm shed, the air quality is constantly declining, if not timely treatment, it is likely to cause very bad effects on the human body. Therefore, the effect of air purifier is remarkable.

III. Discussion and conclusion

My experiments show that different types of air purifiers have different purifying effects, and the electrostatic air purifier has a slightly higher purifying effect than the negative ion air purifier. Electrostatic air purifiers require regular replacement of the filter, while negative ion air purifiers do not require consumables. Both air purifiers have their own advantages and disadvantages. It depends on everyone's needs to buy different kinds of air purifiers. No matter how to say the effect of air purifier is very obvious, it is recommend to buy an air purifierif there are certain economic conditions.

Haze is closely related to China's development in recent years. Sulfur dioxide produced by coal burning in winter, organic matter and waste gas emitted by industrial production, etc., these suspended pollutants produce chemical reactions in the still air and turn into large particles, which promote the formation of haze weather.

For the sake of GDP, the country vigorously develops the automobile industry, encourage people to buy, and ignore the consequences of so many car exhausts on air pollution. All these lead to the deterioration of the environment. We can only do from small things to start saving environmental protection, more green travel, reduce pollution emission sources… and return a beautiful blue sky to Beijing!

IV. Experience and Gains

This is the first time I've experienced a scientific experiment process since I was in high school. This experiment increased my hands-on ability, but also let me know how to insist and never give up until achieve the goal. Continuously do many groups of experiment, and every time you need to be very careful, because a single mistake can make the results less rigorous. And regardless of the gap between the facts and the expectations, it is necessary to be realistic. I know more about the whole process of scientific research, and I benefit a lot for the experiment.

Thanks

References

1、Cause of haze weather"Baidu Library
Http://wenkubaidu.com/view/211a65f5f01dc281e43af06d.html

3, negative ion air type air purifier--Baidu Encyclopedia
Http://baike.baidu.com/view/2355234.htm

4, electrostatic type air purifier--Baidu Encyclopedia
Http://baike.sogou.com/v10470872.htm?fromTitle

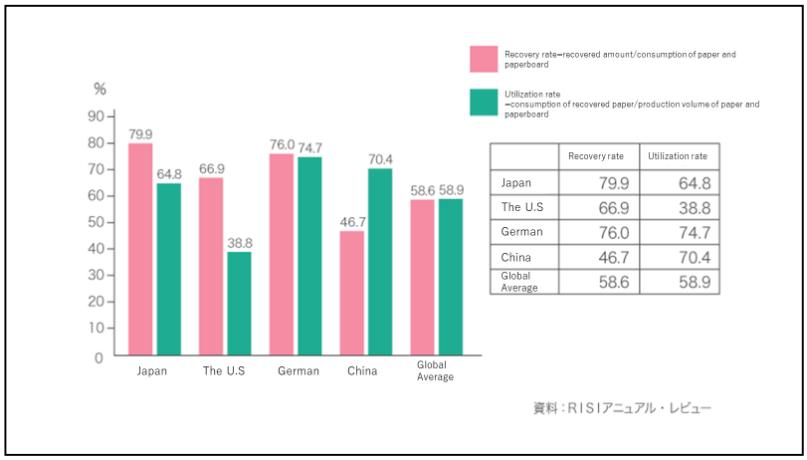
The Possibility of Reducing the Amount of Waste by Using Recovered Paper

Otemae High School
Maki Matsumura

Introduction

When I used a bathroom in the U.S., I was shocked to see the piles of trash used as paper towels and that kind of scene was seen at almost every bathroom. Because we hardly ever use that much paper towels in Japan, that scene gave me a great culture shock and made me interested in the world garbage problem focused on The U.S., "paper trash" in particular.

While I was researching this issue on the Internet, I caught on a fact that Japan is at highest level of recycling recovered paper. According to the graph on the right, Japan collected the most paper in 2016. When you pay attention to The U.S., you might realize the large gap between recovery and utilization rate. I thought this could be one of the causes of the waste problem and decided to do research on the usage of recovered paper in this country, which was not an affair in just one country but related to a global waste problem.



	Recovery rate	Utilization rate
Japan	79.9	64.8
The U.S	66.9	38.8
German	76.0	74.7
China	46.7	70.4
Global Average	58.6	58.9

1 The impact of recycling recovered paper on the natural environment

Firstly, I started the research with confirming whether recycling recovered paper is actually friendly to the environment. As stated in the report written by Paper Recycling Promotion Center in Japan, the volume of incineration was reduced by 5.9 million, and that of final disposal was cut down by 338 thousand in 2008. This reduction is proved to be the result which the increasing amount of collected recovered paper brought about. Moreover, recovery rate has been growing since then so that it is natural to expect the volume will decrease accordingly.

In terms of the emission of CO2, recycling recovered paper gave off much more carbon dioxide before. However, thanks to the great effort by the companies and the advance of technology, now it emits the same amount as

paper made from fresh pulp does.
Thus, we can say recycling recovered paper helps to make the environment better.

2 The reasons why the utilization rate is low in the U.S.

The United States usually exports the large amount of recovered paper collected domestically. Concretely it occupies around one third of the total volume of recovered paper exported over the world in 2016.
I consider this is because America is rich in forest resources thanks to its vast forests. For this reason, it does not have to rely on recycling recovered paper. And the forest area is not decreasing due to the afforestation.
Then—which country is it that imports recovered paper from The U.S.?

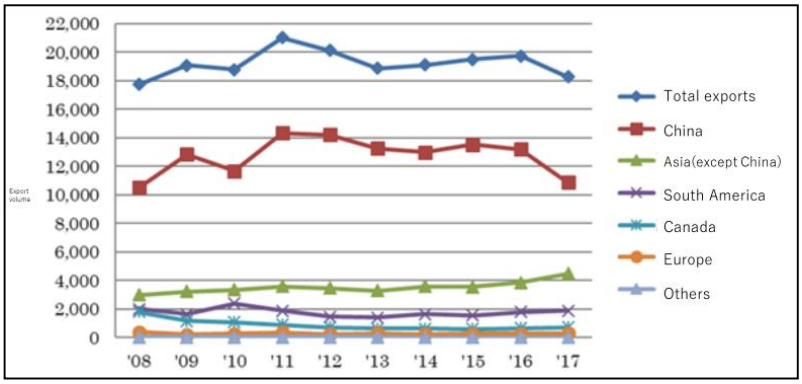
3 The international circulation of recovered paper

Although China imports most of recovered paper from the U.S., its amount is decreasing gradually for a few reasons:

1. China stopped importing mixed paper in December of 2017
2. 25-percent tariff has been applied to recovered paper from the U.S. and Canada since August of 2018

Therefore, the U.S. started to export more paper to the other Asian countries in 2017 as stated in the graph on the left. This policy change of the U.S. seems to be just a change of countries which constitutes this international circulation. That is not something so simple, however.
There are two major emerging issues that might happen next.

1. Even though America exports more paper than before to the other Asian nations, it is impossible for them to make up for all the amount which china imported. So that the amount of recovered paper collected in the U.S. was reduced last year and it means the increase of garbage volume.
2. The factory equipment has not been improved enough in the other Asian countries, so water pollution is likely to be caused.



4 Conceivable causes that China decreased the amount of imported paper

1. The quality of recovered paper from the United States was not good enough since it was collected

in a way called “Single-stream”.
*Single-stream: method of recycling in which all types of recyclables are initially gathered together, and sorted later at a specialized facility
(quoted from SINGLE STREAM; http://www.single-stream.net/about)

2. China is now trying to establish a steady system of recycling in its own country. The government asks people to separate their household garbage before they are collected.

5 Conclusion

As shown above, we cannot say that recycling recovered paper is not always friendly to the environment. At present, there is a likelihood that some of recovered paper collected in the U.S. is not being recycled but gone straight to garbage incineration facilities. I consider it is time to suggest a new practical way that can be alternative to Single-stream method.

6 Reference material

Statistics of recovered paper in The U.S.
http://www.prpc.or.jp/wp-content/uploads/america.pdf
Statistics of recovered paper in China
http://www.prpc.or.jp/wp-content/uploads/china.pdf

Nikkei business
https://business.nikkei.com/atcl/opinion/15/101059/013100136/?P=5&mds
AFP BB news
http://www.afpbb.com/articles/-/3171738
Japan Paper Association
https://www.jpa.gr.jp/en/
“紙パルプ産業と環境 2019　森と紙とエネルギーのリサイクル”
2018.8.24 紙業タイムス社

Energy generation in Australia – Looking to the future.
By Lachlann Cracknell and James Davies
Balcombe Grammar School, Victoria, Australia

Hello, I'm James Davies and this is Lachlann Cracknell and we are from Balcombe Grammar School on the Mornington Peninsula, Victoria, Australia. The school was founded in 2007 having been brought into existence through the efforts of a dedicated group of people who had the vision to provide an affordable Christian school striving for excellence in education, for the families of the Mornington Peninsula. Balcombe Grammar School is a co-educational school with classes ranging from Foundation to Year 12, so from 5 years old to 18 years old. Our school is located close to the beautiful Port Phillip Bay, surrounded by beautiful beaches, amazing wildlife and a lot of rich heritage. This privilege means that our school community is constantly reminded of the importance of nature, and we strive to be environmentally conscious.

Lachlann and I joined Balcombe Grammar in 2014 at the age of 13 and went into what we call Year 7. Balcombe Grammar has a big focus on giving back to the community and maintaining the environment surrounding the school. From Year 5 up until Year 8 Balcombe Grammar runs a program with the students called the Active Community Program or ACP for short, where the students work on community projects such as helping out at a wildlife reserve, gardening at our schools vegetable garden and studying the ecosystem of a local estuary.

In Year 9 students are engaged in an innovative educational program that allows students to learn through authentic real world experiences. For example we learnt about science, the

environment and the history by visiting the areas surrounding our school including Point Nepean, a national park that has previously been used as a quarantine station for new migrants, fortifications in World War 1 and 2, and an army cadet training camp. We got to snorkel and study the marine wildlife and the effects of coastal erosion exacerbated by dredging in the bay, which deepened the shipping channels leading into Melbourne. We also got the opportunity to build our own robots with 3D printed parts and then program them to complete a task or solve a problem. This gave us some insights into the relationship between the environment and technology, and taught us how to think creatively to find world solutions. These skills will be important for our generation as we work internationally on global challenges.

Balcombe Grammar has been focusing on reducing our carbon footprint, the buildings have been architecturally designed to be in sympathy with our surroundings. The classrooms are well-appointed with modern IT resources, passive solar design, along with reverse cycle air-conditioning in each room in an attempt to create an ideal learning environment while making it eco-friendly.

As we have grown up we have been constantly told about the importance of keeping our environment clean and healthy by reducing the amount of electricity and water we use, using recyclable materials, and reducing waste. We have also been told about the impact of increasing carbon dioxide emissions on our climate, and how it is going to have a great impact on not only our generation, but future generations as well. In hearing this, it is extremely frustrating to see the lack of action towards reducing carbon emissions in Australia, as it is clear that we need to do more to transmission to cleaner energy generation and limit climate change as a whole. As students our age, we have limited power to create much change ourselves, but as we are the people who will inherit the consequences of inaction on climate change, it is important that our voices and opinions are heard. Students across Australia, the UK, and other countries around the world, have been taking a stand and showing their discontent by staging student strikes and rallying together to protest the current climate change policies. By doing this the younger generation is able voice their opinions in hopes that the people with the ability to create change will take notice and implement more effective strategies to reduce carbon dioxide emissions.

As you may or may not know, Australia is heavily dependent on fossil fuels to supply our nation's electricity, specifically black and brown coal. Using coal as our main source of electricity production has caused many problems for us as the future generation. We have been using coal for over 100 years and it's about time to find a cleaner alternative. At the moment our home state of Victoria uses brown lignite coal to fuel our power stations. This type of coal is the least efficient and produces more carbon dioxide than any other type of coal. However, we are not completely coal dependent.
The Victorian government has already set up various initiatives such as the Bald Hills wind farm, consisting of 1,750 hectares of farmland with 52 wind turbines The island state of Tasmania is a place we can look up to for renewable energy as they produce 98% of their energy from a hydro-electric dam.

When we look north to New South Wales where they have the Snowy Hydro Plant. This power station gets its water from the flow from the Murrumbidgee and Murray rivers, two large rivers in Australia. The water is used to turn the generators thus generating electricity. Over the 16 power stations, the Snowy Hydro scheme generates 4500 GWh per annum, which is enough to power hundreds of homes in the region.

Looking to Western Australia, there has been a development in energy production called ECHO2 processing - a low cost, renewable source of energy. The project is called "Rainbow Bee Eater", after a bird found in Western Australia, it aims to produce a low cost alternative to LPG (Liquid Petroleum Gas) by using the by-product of eucalyptus oil production. The company harvests eucalyptus trees sustainably for oil which is in demand for the manufacture of many products. The by-product of this is pressed eucalyptus mulch, known as biomass. The company has a process they call "ECHO2" that processes this waste material. The biomass is placed in a special reactor called a pyrolyser. Heating to high temperatures in the pyrolyser converts the biomass to Syngas and a carbon residue called biochar. The syngas is burnt to power a generator which powers the

pyrolyser and provides power to greenhouses adjacent to the ECHO2 plant. The clean carbon dioxide emission from the plant is pumped into the greenhouses to stimulate crop growth. The biochar can be used as a soil enricher for agriculture. The process uses a sustainable resource, produces little waste and enables crop growth. Plus, it produces excess electricity that could be used to power small country towns.

An emerging technology being tested by the Commonwealth Scientific and Industrial Research Organisation, or CSIRO for short, is enhancing the awe inspiring strength of waves and the ocean. This seeks to make rafts that use the currents like a normal hydroelectric dam to create energy that we can use. This would be perfect for the average Australian as the majority of our country's population lives around the edge of the country that is nearer to the ocean. The rafts could be placed all along the perimeter of the land.

Australia is a huge country and therefore needs a large and reliable power supply. At the moment this is petroleum and coal fulfil these demands. The challenge we have is developing enough 'base-load' power for the country.

One problem with power generated by wind turbines and solar power plants, is that there is no power is produced when the sun is not shining or the wind is not blowing. However, there can be an excess of electricity generated at certain times. Storage of this energy for use during low generation times is the solution. Some large-scale solutions may include battery pumped hydro storage. There is also a new project that has just received government funding that stores energy by compressing air.

Some of you have probably heard that the CEO of Tesla and spaceX, Elon Musk built Lithium Polymer batteries in the Australian state of South Australia. Before Mr Musk's project was completed, South Australia payed huge amounts of money for unreliable energy. The power was known to stop on really hot days with the increased energy demand from air conditioners, as temperatures can approach 50 degrees centigrade. Elon Musk offered to build the batteries that store the power from nearby wind farms so if South Australia ran out of power, the government could take the stored power and give the system a window of opportunity to go back online. The project means that power supplies are more reliable and can cope in the sweltering heat of Australian summers without turning to fossil fuels.
The Australian Federal Government is also investigating the feasibility of a scheme to use excess renewable power to pump water to existing hydroelectric dams in the high country of New South Wales. The water can then be run back through turbines to generate power when renewable sources are down.

Some communities are not waiting for larger scale projects to make a difference. A husband and wife named Lyn and Doug Scouller have built their own solar farm in the Australian outback. They and their town had suffered from the same power

failure ssues as South Australia, the power station where they got their electricity from was extremely far away from their town, and the prices for energy was high. So to fix the problem they made a solar farm that can power not only their town, but another one nearby. This story brings up an interesting point for how Australia can supply our towns with renewable energy being such a ginormous country. That is to build local, renewable, small power plants, rather than a large power stations that are fuelled with coal.

International cooperation and collaboration will be key to developing affordable and effective solutions. We know that the world can coordinate efforts on global issues effectively, such when the Montreal Protocol was followed to address the depletion of the ozone layer. Japanese and Australian scientists have worked together on developing photovoltaic technologies. The huge floating solar panel installation in Chiba, Japan uses technology originally developed in France, and is projected to produce enough electricity to power nearly 5000 homes. Individually we can make a difference, but by working together we can really change the world. According to 'Japan for Sustainability', Japan has the third largest geothermal reserves in the world. This has the potential to produce 23,470,000 kW of electricity and power 40 million homes! Because this energy is constant over the year, and is as cheap to produce as gas energy, Japan could certainly consider it for base load power. This would greatly decrease Japan's global footprint. There are hot-springs near our school on the Mornington Peninsula, and other locations near Melbourne, so perhaps in the future we could be using geothermally generated electricity in our school and homes!

It is clear that there are many different technologies that Australia can adopt, whether it be huge hydro-electric schemes, giant solar farms, developing technologies in bio-fuel, tidal and wave energy from our oceans, and geothermal. There are many different paths that could be taken to transition to renewable sources of energy, but it is clear it will require more than one technology, and international collaboration to be successful. Let us lead by example and begin implementing these ideas, not just in Australia, and Japan, but around the world. If we share our knowledge, not only will the world benefit, but we all will as our sense of international friendship will be strengthened.

Assessment of Campus Environment

Shanghai Foreign Language School

Distinguished guests, ladies and gentlemen,

Despite the fact that the largest source of pollution is agriculture and industry, we urban citizens still care a lot about the environment. As teenagers, a large proportion of our time is spent on campus. If we want to understand our impact on the environment, it is inevitable to evaluate how eco-friendly our school is.

Thus, we started to assess our campus. To conduct such an assessment, we specifically focused on two aspects: the facilities' eco-friendliness and the eco-friendly awareness of people on site. These two factors mostly affect how eco-friendly a campus is. With energy-consuming facilities, a campus can never claim itself eco-friendly. With people lacking eco-friendly awareness, a campus cannot claim to be eco-friendly either, as abundant resources would supposedly be wasted.

To measure the eco-friendliness of the facilities on campus, we went through an investigation on facilities such as fluorescent tube, interior temperature, air conditioning system, personal heaters/fans, window glass, detergents, refrigerator, microwave oven, taps, toilets, soap, printers, etc. We then quantified these items based on whether they are eco-friendly. We mostly referred to the China Energy Label sticked on the electrical appliances and scored it accordingly. For facts such as whether the printers are energy-saving, we added points if one item is positive for saving energy/resource.

To measure the environmental awareness of people on campus, including students, staff members and teachers, a survey focused on behaviors, perceptions, and concerns, which all serve as practices of environmental awareness, was conducted. Questionnaires were drawn to study such factors and are quantified accordingly. We asked about means of transportation, air conditioning using habits, paper using habits, electricity using habits, recycling habits, perception on waste classification and environmental policies, attention on air quality and campus environment, etc. The more behaviors positive to protect the environment, perceptions about environmental protection, concerns about the environment, tthe higher the score for eco-friendliness. In addition, we conducted an individual review. Random interviewees were selected to talk about the reasons behind their choice in the survey. Word frequency analysis was conducted to show the degree of environmental awareness. With such interviews, we are enabled to have a qualitative research to have a deeper understanding of people's motivations behind their choices in the survey.

Our results suggested that the campus are not eco-friendly enough. For instance, the taps are not water-saving; the lights are often on in the offices and classrooms even

when no one is there; the soap does not contain eco-friendly ingredients; no bins are for students to do waste classification; most students and teachers have no clear understanding for waste classification, etc. However, we have a paper recycling program every semester; there are a total of 59 different kinds of plants on campus; the air conditioners are only turned on when the temperature is over 30 ℃ and we rarely use them in the winter. We are now clear that many improvements remain to be done.

So, we provided our recommendation. For example, we can promote waste classification by education and new eco-friendly policies; we can reduce using disposable cutlery by encouraging teachers to eat at canteen instead of using disposable cutlery and lunch box, and using mugs for guests instead of disposable cups; we can also start recycling water bottles. Meanwhile, we have already submitted a proposal about waste classification education to school so that the campus can be more eco-friendly.

We sincerely believe that our effort can make a difference. Although protecting the environment is often neglected by most schools in China, with an overall understanding of the eco-friendliness our school, our school administration can now take our assessment as a reference when new construction work is to be done or new policies to be made. We will also start adding trash bins for classification, giving lectures and broadcasts on waste classification, changing the taps into water-saving taps, and so on. Putting our research into application is our next step.

Thank you for listening.

Light Damage

Yujin Tanaka/ Ozora Mifune/ Nana Sumikoshi/ Miho Yamashita

1. Introduction

Today we are going to talk about "**Light Damage.**" These days, since the world is becoming brighter, many plants and animals are suffering from over-exposure to light. As environmental issues are becoming serious, we have many opportunities to study and think through these problems. As light damage is not a well-known issue, we wanted to research, give a presentation, and share information with other people.

2. Objective and Advantages

Objective

To measure the speed of growth of animals and plants under conditions in which we have too little or too much LUX.

Why study this topic?

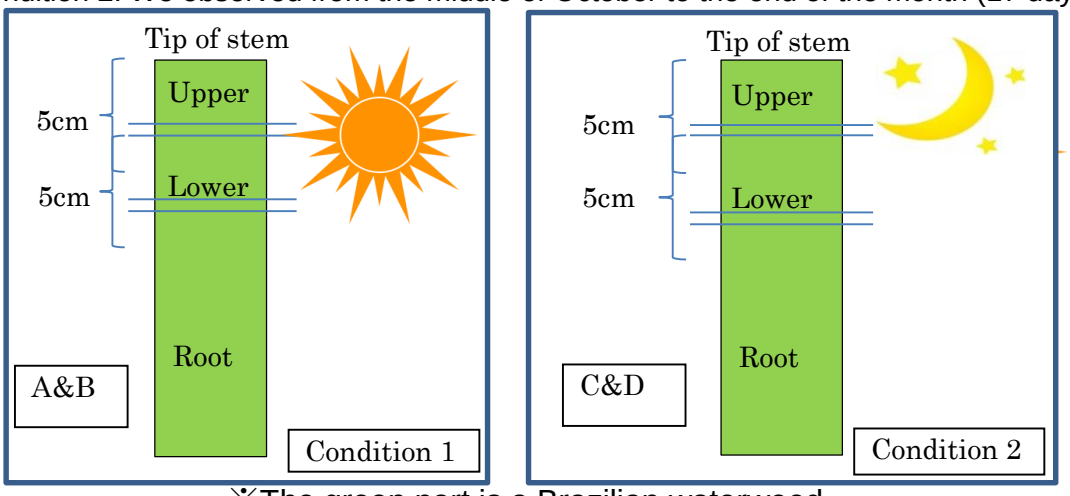
We can find out about the effects and the importance of light.

We can predict what would happen to animals and plants when sunlight becomes stronger or weaker.

3. Experiment (1)

The growth of *Egeria densa* (Brazilian waterweed)

To check out whether there is any relationship between the speed of growth in the stem and the time the plant is exposed to light, we experimented under the two conditions. We cut off the first 5 cm from the tip of the stem, (A) and (B). Then we kept them exposed to light in an artificial climate chamber – condition 1. And we put another *Egeria densa,* (C) and (D), in a different beaker and exposed them to normal daylight – condition 2. We observed from the middle of October to the end of the month (17 days).



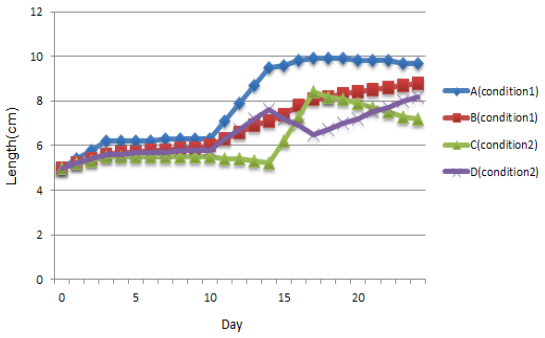
※The green part is a Brazilian waterweed

Prediction

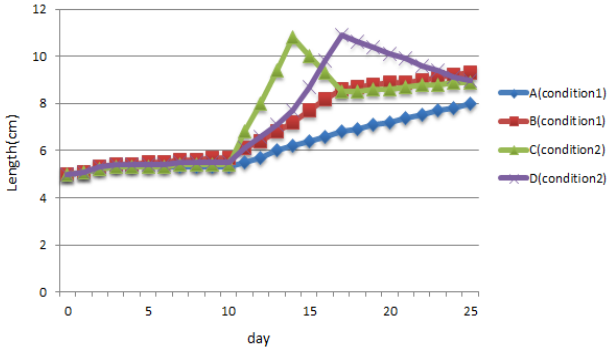
We predicted that because (A) and (B) get almost about twice as much light as (C) and (D) do, photosynthesis would occur at twice the rate. We also predicted that because plants grow faster near the tip, the upper part will grow faster than the lower part.

Results

The upper part, (A) and (B), grew 1.22cm on average more than (C) and (D) over the 17 days of the experiment. However, we got a different result for the lower part. (C) and (D) grew 1cm more than (A) and (B) did over the same time. We couldn't find any color differences between (A) and (B) or (C) and (D).



The upper 5cm



The lower 5cm

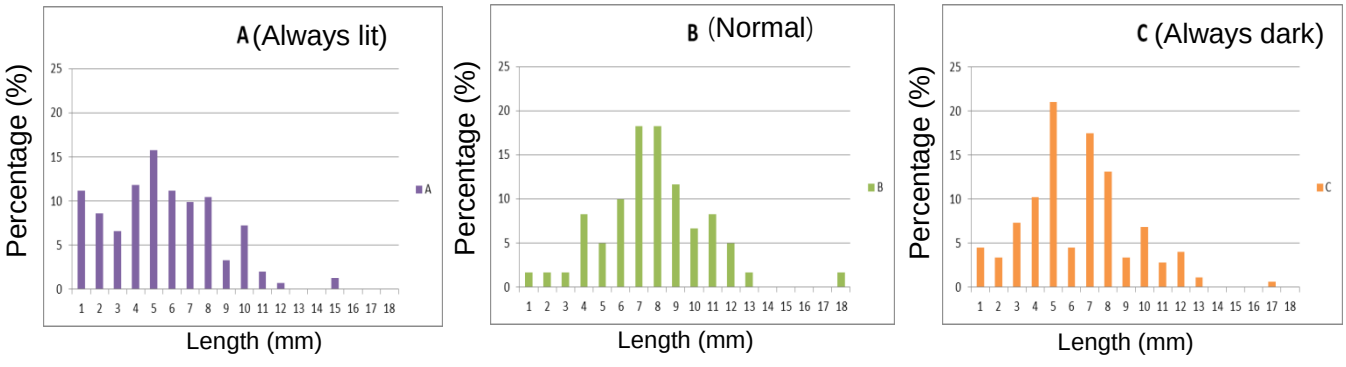
Consideration

(A) and (B) grew more than (C) and (D) did in upper part. We think this is because the growth speed in the stem is deeply connected to the growing point which is locating there. Therefore, we got results like this. We are not quite sure why (C) and (D) grew more than (A) and (B) did in the lower part yet, so we'd like to continue our research.

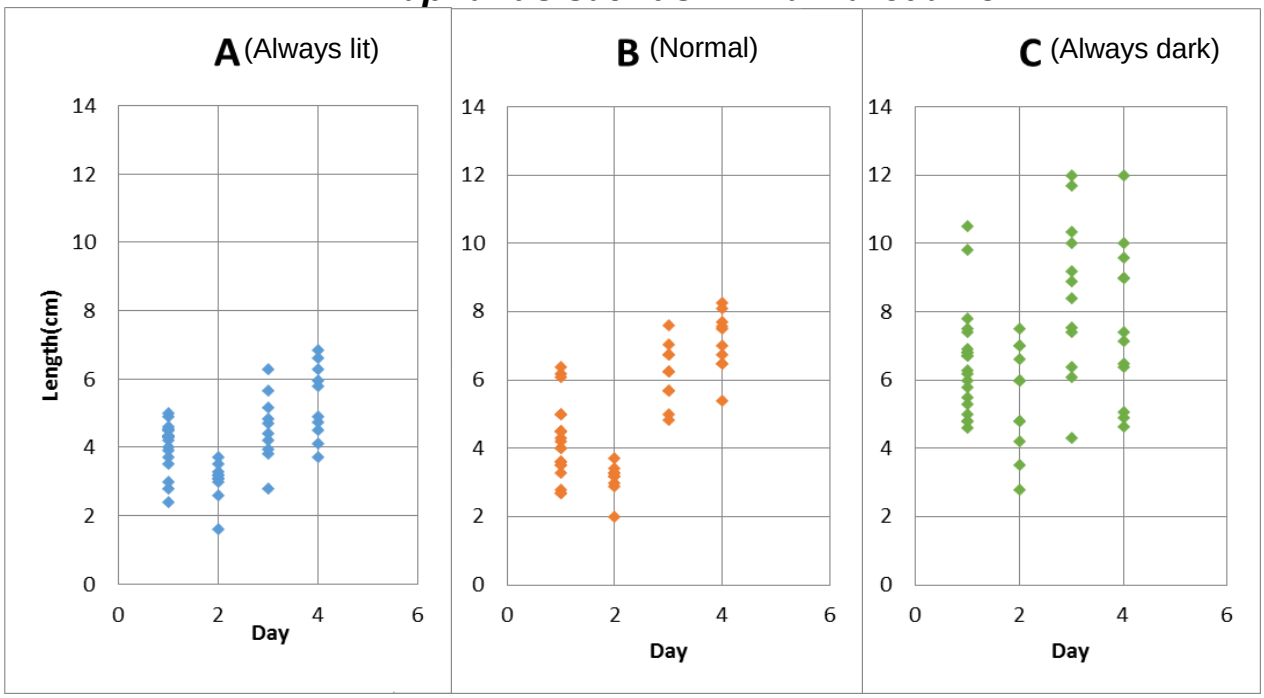
This is one of the report sheets that we made through our research

※ We did the same experiment with *Allium fistulosum* (Leek), *Raphanus sativus.L.'Kaiwaredaikon'* (White Radish Sprouts), *Armadillidium vulgare* (Pill bugs) and *Oryzias latipes* (Medaka) . We will explain about them in more detail when we give our presentation,

~Allium fistulosum~



~*Raphanus sativus L. 'Kaiwaredaikon'* ~



~*Armadillidium vulgare*~

11/5		start									
		A	B	C							
		3	5	4							
11/9	First time	3	4	4							
					start						
					A	B	C				
					3	3	3				
11/2	Second time	0	3	4	0	3	3				
								start			
								A	B	C	
								3	3	3	
11/19	Third time		2	4		3	2	0	3	3	

4. Conclusion

If something is exposed to light all day, it changes. For example the color will become dark or discoloration will occur in plants, and animals may die or become over-active. Therefore, being exposed to light for a long time usually has bad influences on plants and animals.

5. Future Plan

We would like to continue our research on other species and eventually research on humans as well.

Questionnaire: What do you feel about this International High School Science Conference?

◎Answers from Teachers

・My students and I got a lot of ideas and knowledges. This conference is very useful and encourage my student to be a leader, thinker, creative and effective person.

・Very well organized. Allowed plenty of preparation time for the students. This was helpful. Very time efficient. Friendly staff and students. EXCELLENT OVERALL.

・Well organized, and hosted. A wonderful experience. Students were given good opportunities to practice and prepare.

・本大会に参加した高校生の皆さんは、時間をかけて真面目に資料の検索をしたり、実験をしたりして、たくさんのデータを集めてレポートを完成した上で、流暢な英語で発表したことに感心しました。内容のある質問がたくさん出されたことで、大手前高校の生徒はどんなに真剣に理科の学習に取り組んでいるのか理解できました。

・Well prepared and organized. Everything was right on time with the schedule. The conference was set up formally for the students to experience the real presentation. Otemae high school students (the audience) were well prepared to attend the conference and to ask questions. (They seemed to know very well on the theme of the presentation.

◎Answers from Students

・I felt that the international High School conference was a great opportunity for us as students to take a step out of our confort zone and to make new friends. The event was very well organized and I am thankful for how welcome I felt. I really appreciated the extra preparation day beforehand.

・It is amazing to hear from students of different countries and learn about their projects. Thank Otemae Highschool for inviting us. the auditorium is impressive, and so were the questions from students. I really enjoyed it.

・The hall is very big, so I was very nervous at first. I presented at 1 places and then listened to another presentation. Every project was so interesting and its inspired me so, I was really have a nice day for new-knowledges.

・I am really delighted to attend the conference, sharing the project we have carried out and listening to wonderful speeches made by other students from Japan and all over the world .I am looking forward to attending such conferences in the future.

・It is very interesting. Every project is very good. But it took a little long time. However, It is perfect. You managed it very good.

・The amount of rehearsals was very helpful as it gave us an insight into what we were to expect on the day. The teachers were very helpful guiding us around.

大手前高校生対象　高校生国際科学会議　アンケート結果

１年生　３０６人、２年生文理学科　１２０人、合計４２６人

アンケート結果

設問	1 よく あてはまる	2 やや あてはまる	3 あまりあて はまらない	4 あてはま らない
Q1 国際科学会議に参加して、英語のコミュニケーションの必要性を感じた。	317人	93人	10人	6人
Q2 国際科学会議で発表されていたことに対して、興味関心を持つことができた。	142人	188人	83人	13人
Q3 国際科学会議で発表した海外の高校生や大手前生から、良い刺激を受けた。	243人	153人	25人	5人

生徒の感想

・それぞれの発表者が、それぞれの国や地域の状況や環境に基づいてプレゼンを構築し、発表していて、環境問題と同時に土地柄と合う、ということを考える必要があることが分かった。

・いろんな国の高校生の研究したことや意見を聞くことにより、それぞれの国での環境やエネルギーについての問題が分かって興味深かった。また、このような意見交換の場は英語が分からないと成立しないから、英語の大切さを改めて実感した。

・研究のレベルが高くて驚いた。

・英語を通じて世界各国の高校生の研究に興味をもつことができ、とても良い経験になった。もっと英語を使えるようになり、国際的な場で活躍できる人になりたいと思った。

・質問に対する答えを英語ですぐに言えるのは、英語ができる上にその問題についてよく知っておくことも大切だと感じた。

・英語をすらすら話している先輩方の姿がかっこいいなと思った。英語を母国語としない国の学生同士で、英語を使ってあんなに議論できるのがすごいと思った。自分もこれから、もっと積極的に英語を使っていきたい。

・プレゼンテーションの内容だけでなく、英語での発表や、話し方などを見て、深い感銘を受けた。自分も一年後、身についているように頑張りたい。

・自分の英語力の無さを痛感した。話すスピードが速く聞き取ることができなかった。しかし、スライドを分かりやすくしている発表が多く、何となく伝えたいことが分かった。伝えるために工夫しているのは素晴らしいと感じた。

・英語が流暢なのもすごいが、堂々と発表していたことが一番すごかった。また、質問が浮かんでくること、それにしっかりと答えていることにも驚いた。

・海外の高校生の英語の発音はとても流暢で全く分からなかった。だけど、大手前の先輩の発表は発音が良い上にジェスチャーやアイコンタクトがあってよかった。

・英語についても、課題研究についても、もっと向上心をもって取り組みたいと思った。どのプレゼンテーションもハイレベルでついていくのに必死だったが、良い刺激をもらえた。また、同時に自分もこのような舞台に立ちたい、立てるようになりたいと思った。

・環境問題は国内外を問わず、考えていくことができることの一つなので、今回のテーマにとても合っているなと思った。

・質問に対して的確に答えられていて、驚嘆した。英語を通して、様々な国の高校生が交流する場があって、貴重な体験ができた。

・あっという間に時間が過ぎていった。

・どの研究に対してもいろいろな疑問が湧いた。その疑問に対して論理的に回答してくれた人も、そうでない人もいたので、自分は論理的に回答できるようになりたい。英語力を上げたいと思った。

・どの高校もそれぞれの特色を持っていて、高校によって紹介する物のフォーカスが異なっていたのでおもしろいと感じた。また、研究発表の中で、他の国のグラフや図、数字、例を挙げて話を展開している所は、見習うべきよい点だなと感じた。

Outline of the 2019 International High School Science Conference

1 Aim of this conference

We invited high school students from Asian and Oceanian countries. This program was set up to help foster future science researchers, both in Japan and abroad through research presentations about "World Environmental and Energy Problems", discussion and collaboration. This conference is aimed at promoting students to have a global viewpoint, and acquire practical skills to share their research information with the world.

2 Date/Place

26th March, 2019　12:50～16:00 /　L-Osaka

3 International Guest List of Schools

Beijing 101 Middle School, People's Republic of China
Shanghai Foreign Language School, People's Republic of China
Hansung Science High School, Republic of Korea
Chulalongkorn University Demonstration Secondary School, The Kingdom of Thailand
Balcombe Grammar School, Commonwealth of Australia

4 Special guests/Advisers

Yasuko Obana（Kwanseigakuin University）
Keiji Nishida（Osaka Board of Education）
Yoshikazu Ishida（President of Kinrankai ,General foundation）
Toshihiro Akaike（Biomaterials Center for Regenerative Medical Engineering）
Toru Nakano（Osaka University）
Jun Matsui（Konan University）
Hisao Atsumi（Kinki University）
Claudine Ngoh（Trinity College Melbourne）
Saori Tominaga（Australia Consulate-General）

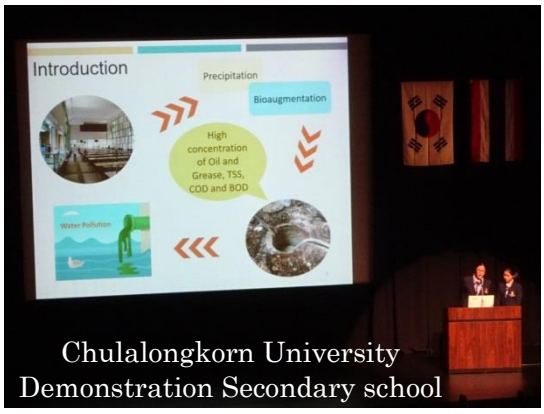
5 Schedule

Opening Address	Masaya Matsuda （Principal of Osaka Prefectural Otemae High School）
Congratulations	Keiji Nishida（Osaka Board of Education）
Presentation①	Chulalongkorn University Demonstration Secondary School
Presentation②	Beijing 101 Middle School
Presentation③	Osaka Prefectural Otemae High School
Presentation④	Balcombe Grammar School
Presentation⑤	Shanghai Foreign Language School
Presentation⑥	Osaka Prefectural Otemae High School
Adviser's comments	Yasuko Obana（Kwanseigakuin University）
Closing ceremony	

高校生国際科学会議　３月２５日(月)～２８日(木)の係分担

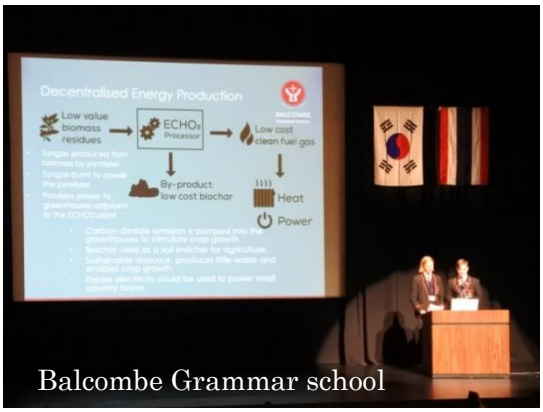
区分		内容		担当
総務 ◎長谷川	記録・報告 ◎江原	カメラ（26日）		○金子・網谷・蜂須賀
		ビデオ（26日）		○江原・中出
		アンケート回収（26日）		○湖山・武智
	渉外 ◎長谷川	午前受付（26日）		○澤井・長谷川
		午前来賓を会場へ誘導（26日）		○田中衣
		午後受付（26日）		○溝脇・吉田
		午後来賓を会場へ誘導（26日）		○石田
国際科学会議 課題研究発表 ◎植野	会場 ◎植島	会場の準備と撤収（26日）		○植島・加川・花崎
		受付の準備と撤収（26日）		○山田・濱鍜・角藤・田中衣・石田
		機材の準備と撤収（26日）		○小泉・安良田・藤井
	生徒	館内誘導、着席指導（26日）		○林・青木・村上・野坂・貴田 山本・森蔭・松山
		点呼		１年担任、２年文理学科の担任
	課題研究発表 ◎黒松	午前進行・質疑応答（26日）		○佐藤・植野・小泉・花崎・橋口
		ポスターセッション （準備25日～撤収26日）	25日午後： パネルの搬入	○黒松・増本・髙畑・岡・井上・ 湖山・武智
			26日： パネルの移動・撤出	○黒松・板口・髙畑・岡・井上・ 北田・中井・ジョージ・安良田・ 橋口・角藤
			１Ｆエレベータ整理	○溝脇・吉田
			26日午前： ポスター発表時	○黒松・板口・髙畑・岡・井上・ 濱鍜・加川・植野
	プレ会議	プレ会議（25日）当日打合せ（26日）		○日下部・山田・村上 川口・蜂谷・岩村・鶴元
	国際会議 ◎植野	午後進行・質疑応答（26日）		○植野・佐藤・瓜生・文田・藤井
海外 (生徒・教員) ◎瓜生	お迎え ◎谷	送迎（25／28日）		○兼崎・後藤・北田・桃田・ ｼﾞｮｰｼﾞ
		海外進学説明会（25日）		○瓜生・濵・山本
		茶道部（25日・海外生徒を学校でお迎え）		○藤原・松山
	ﾎｰﾑｽﾃｲ	ホームステイ先へ（25日）		○川口・蜂谷・岩村・鶴元
	京都研修 ◎山本	京都研修（27日）		○山本・竹田・北田・藤原 (事前準備：森蔭・松山)
	ﾚｾﾌﾟｼｮﾝ ◎濵	レセプション・お礼の会（27日）		○濵・川口・蜂谷・岩村・鶴元
会計 ◎乙咩	会計	予算・決算・費用支払い		○増田・芝本・西脇
	食料	昼食、飲み物の手配		○浅野・三浦・石川
救護 ◎元木	救護	救護全般		○元木・大川

Presentation



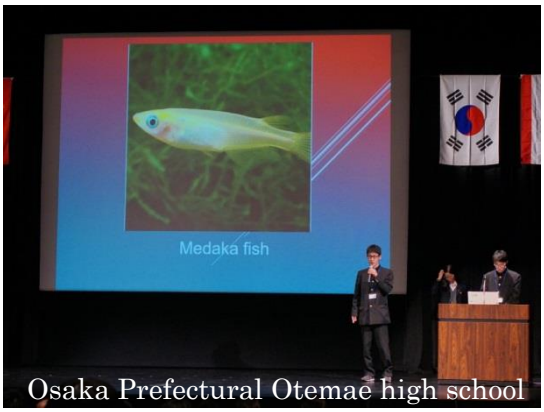
Chulalongkorn University Demonstration Secondary school

Beijing101high school

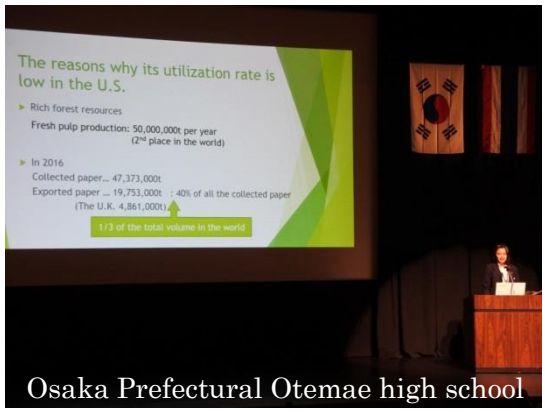


Balcombe Grammar school

Shanghai Foreign Language school



Osaka Prefectural Otemae high school



Osaka Prefectural Otemae high school